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MARKED UP VERSION OF THE CLAIMS INDICATING THE CHANGES MADE

We Claim:

1. (Once amended) An integrated circuit package comprising:

an integrated circuit die, said integrated circuit die having a top side and a bottom side opposite said top side, said top side including at least one bond pad;

at least one raised interconnect located over and conductively coupled to said at least one bond pad; and,

a flexible dielectric circuit film having a top surface, a bottom surface and a routing conductor, the flexible circuit film having at least one outer landing formed on the top surface and at least one inner landing formed on the bottom surface such that the landing on the top surface is fully supported by the underlying circuit film and the landing on the bottom surface is fully supported by the overlying circuit film, wherein the outer landing is laterally offset from the inner landing and the two landings are connected via the routing conductor, the flexible circuit film being located over and conductively attached to at least one raised interconnect such that an air gap is formed between said integrated circuit die and said flexible circuit film.

5. (Once amended) The integrated circuit package of claim [4] 1 wherein said outer landing is offset a horizontal distance from said inner landing, and further wherein said horizontal distance in the range of between about 50μm to 1,000μm.

6. (Once amended) The integrated circuit package of claim [4] 1 further comprising at least one contact bump conductively coupled with said outer landing of said flexible circuit film.

15. (Once amended) An integrated circuit wafer having a top side and a bottom side opposite said top side, said integrated circuit wafer comprising:

a plurality of integrated circuit dice, said plurality of integrated circuit dice having a plurality of bond pads located on said top side of said integrated circuit wafer;

a plurality of raised interconnects formed over and conductively coupled to said plurality of bond pads; and,

[a flexible circuit film applied over and conductively attached to said plurality of raised interconnects such that an air gap is formed between said integrated circuit wafer and said flexible circuit film.]

a flexible dielectric circuit film having a top surface, a bottom surface and routing conductors, the flexible circuit film having a plurality of outer landings located on the top surface and a plurality of inner landings located on the bottom surface the landings on the top surface are fully supported by the underlying circuit film and the landings on the bottom surface are fully supported by the overlying circuit film, wherein the individual outer landings are laterally offset from the individual inner landings and the landings are connected via routing conductors, the flexible circuit film being located over and conductively attached to the plurality of raised interconnects such that an air gap is formed between said integrated circuit wafer and said flexible circuit film.

19. (Once amended) The integrated circuit wafer of claim [18] 15 wherein each of said plurality of outer landings are offset a horizontal distance from a corresponding one of said inner landings, and further wherein said horizontal distance is in the range of between about 50μm to 1,000μm.

20. (Once amended) The integrated circuit wafer of claim [18] 15 further comprising a plurality of contact bumps formed on and conductively coupled with said outer landings of said flexible circuit film.

REMARKS

Claims 1-3, 5-7, 15-17 and 19-28 are pending in this application. Claims 4 and 18 have been canceled. Claims 1, 5, 6, 15, 19 and 20 have been amended. New claims 21 through 28 have been added.

The invention as set forth in amended claims 1 and 15 comprises a flexible circuit film conductively attached to an integrated circuit die and an integrated circuit wafer. The amended claims reflect the fact that this attachment is achieved, in part, via one or more top and bottom landings which are **fully supported** by the substrate upon which the landings are fabricated (see Figures 4 and 5).

The Examiner has rejected claim 1 under 35 U.S.C. 102(b) as anticipated by Hidetoshi Takeda, et al, U.S. Patent No. 5,892,271 ("Takeda").

In Takeda's embodiments I, II and VI the conductive leads are all located on the same surface of the flexible layer (the side adjacent to the IC in embodiment I as shown in Figures 3 and 4, and the side farthest from the IC in embodiment II and VI as shown in Figures 5 and 9) and the conductive bumps are directly attached to those leads without the benefit of underlying substrate support. In amended independent claim 1 of the present application, the leads used to connect the landings are formed on the top and bottom surfaces of the **flexible layer** so the raised interconnects (equivalent to the conductive bumps in Takeda) are directly attached to a supported surface. The advantage over Takeda is in the strength of the resulting structure. As shown in Figures 3, 4 and 9 of Takeda, there is no substrate under the places where the conductive bumps are attached to the conductive leads. In Takeda's embodiment II (see Figure 5), only the bottom conductive bumps are attached to the substrate. It is clear that the unsupported connections in Takeda are more susceptible to failure than the connections required by the present invention's amended claim 1, where the landings on the top and bottom surfaces of the flexible film are fully supported by the underlying substrate. If this were not so, Takeda would not have found it necessary to disclose embodiments III and IV with **resin reinforcements** added to strengthen the junctions. It is respectfully submitted that the fully supported landings are a significant distinction and, accordingly, it is submitted that Takeda embodiments I, II and VI do not anticipate the structure required by amended claim 1 for at least this reason.

In Takeda's embodiments III-IV (described in Figures 6 and 7), the conductive bumps are attached in the same manner as in embodiment II, but resin is added so that "the junction portion between the projection bump and the conductive lead can be reinforced." Takeda, col. 7, lines 56-58. The addition of resin adds an extra step to the process of attaching the flexible circuit film, creates new stresses in both the substrate and the film, and introduces the possibility of contamination by the resin. The junctions required by amended claim 1 are stronger than those in Takeda and do not require resin to fortify inherently weak junctions between the leads and the conductive bumps. In light of at least this difference, it is respectfully submitted that Takeda embodiments III-IV do not anticipate amended claim 1.

Takeda's embodiment V (Figures 8 and 11) uses a resin layer between the flexible substrate and the IC, as opposed to the air gap of amended in claim 1. Therefore embodiment V does not anticipate the structure required by claim 1 for at least this reason.

It is respectfully submitted that none of the embodiments disclosed in Takeda anticipate amended independent claim 1. Further, Takeda cannot make claim 1 obvious because Takeda does not show the use of fully supported landings. Takeda realizes the problem of the weak junctions in his design and poses the solution of adding resin to fortify the junctions, which is a completely different approach than that set forth in claim 1. The solution required by claim 1 is neither disclosed nor reasonably suggested by Takeda, and it is respectfully submitted that this claim should be allowed.

The examiner has rejected claims 2-7 under 35 U.S.C. 103(a) as being unpatentable over Takeda, et al. in view of Masatoshi Akagawa, et al., U.S. patent No. 5,834,844 ("Akagawa").

Claim 4 has been cancelled. Claims 2, 3, 5, 6 and 7 each depend either directly or indirectly from amended independent claim 1 and therefore are respectfully submitted to be patentable over the art of record for at least the reasons set forth above with respect to claim 1. Furthermore, while it is conceded that Akagawa teaches the use of under bump pads, it makes no mention of a flexible circuit film to support the landings. The combination of Akagawa with Takeda does not yield the fully supported landings or the routing conductor arrangement claimed by the present application. Thus, Akagawa does not overcome the deficiencies of Takeda and it is respectfully submitted that claims 2, 3, 5, 6 and 7 are patently distinguishable from the art of record for at least these reasons. Additionally, these dependent claims require additional elements that when taken in the context of the claimed invention, further patentably distinguish the art of record.

The examiner has rejected claim 15 under 35 U.S.C. 102(b) as anticipated by Thomas H. DiStefano, et al, U.S. Patent No. 5,518,964 ("DiStefano").

Amended claim 15 requires a flexible circuit film where the routing conductors must be internal to or on one or both surfaces of the flexible circuit film. This conclusion follows naturally from claim 15 because the conductors must connect to the landings, which are only located on the top and bottom surfaces of the flexible circuit film. In contrast, DiStefano teaches a flexible dielectric substrate where the leads are constructed so that an air gap is formed between most of each lead and the flexible substrate (DiStefano figure 13 shows that the leads taught by DiStefano **must** be located on the bottom surface of the substrate). Further, the conductors in DiStefano must be partially detached from the flexible film by a mechanical process (see DiStefano Figure 15). Additionally, the flexibility of the structure in DiStefano comes mostly from the partially detached conductors, not from the flexible film. The structures described in DiStefano are far more complex than those required by amended claim 15, making them more expensive to manufacture and more susceptible to failure. In light of at least these differences, it is respectfully submitted that DiStefano does not anticipate amended independent claim 15. Further, DiStefano cannot make claim 15 obvious because it does not show the routing conductor arrangement required by claim 15. DiStefano's conductive leads are fully external to the circuit film and only attached at one end, while the conductors required by the amended independent claim 15 in this application are either internal to or on one or both surfaces of the flexible circuit film. The solution required by claim 15 is neither disclosed nor reasonably suggested by DiStefano, and it is respectfully submitted that this claim should be allowed for at least these reasons.

The examiner has rejected claims 16-20 under 35 U.S.C. 103(a) as being unpatentable over DiStefano, et al. in view of Akagawa, et al.

Claim 18 has been cancelled. Claims 16, 17, 19 and 20 each depend either directly or indirectly from independent claim 15 and therefore are respectfully submitted to be patentable over the art of record for at least the reasons set forth above with respect to claim 15. It is noted that Akagawa discusses the use of under bump pads, but does not mention a flexible circuit film. Further, the combination of Akagawa with DiStefano does not yield the fully supported landings or the routing conductor arrangement required by the present application in independent claim 15 or in dependent claims 16, 17, 19 and 20. Thus, Akagawa does not overcome the deficiencies of DiStefano and it is respectfully submitted that claims 16, 17, 19, and 20 are patently

distinguishable from the art of record for this reason as well. Additionally, these dependent claims require additional elements that when taken in the context of the claimed invention, further patentably distinguish the art of record.

Claims 21-28 have been added to clarify the features of the flexible dielectric film. All claims depend from allowable independent claims 1 or 15 and are allowable for at least the same reasons as the independent claims.

In view of the foregoing, it is respectfully submitted that the claimed invention as presently presented is patentable over the art of record and that this case is now in condition for allowance. If the examiner has any continuing concerns regarding this case, he is respectfully requested to contact the undersigned at the number set forth below.

Respectfully submitted,
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